

Sand Pine

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Sand pine (*Pinus clausa* (Chapm. ex Engelm.) Vasey ex Sarg.) is native to the droughty, acid, infertile, marine deposited sandhills of Florida and Baldwin County, Alabama. The largest concentration of the Ocala variety (*Pinus clausa* var. *clausa* D. B. Ward) is in the center of Florida on an area of rolling sandhills known as the Central Highlands. The Choctawhatchee variety (*P. clausa* var. *immuginata* D. B. Ward) is found along the Gulf Coast of northwest Florida from the Apalachicola River westward into Alabama (15). Both of these areas have similar climates with hot, humid summers, somewhat dry winters, and a long growing season of 269 to 312 days. Precipitation is abundant, 53 to 60 inches per year (1345 to 1525 mm), and fairly well distributed; however, because of the low moisture-holding capacity of the soils, drought conditions can exist within 2 weeks of a heavy rainfall. Surface temperatures of exposed soils may reach 140° F (60° C) on summer days (6).

Sand pine is the dominant species of the Society of American Foresters forest cover type 69 (9) on approximately 3 million acres in Florida and shows promise for converting much of the 8 million acres of scrub-hardwood dominated sandhill land to pine in the Southeastern States. It occurs as a minor component of type 70, Longleaf Pine, type 71, Longleaf Pine-Scrub Oak, and type 84, Slash Pine. The understory in Ocala stands is primarily evergreen shrubs 6 to 10 feet (1.83 to 3.05 m) tall with very little herbaceous ground cover (13). Typical understory species are sand live oak (*Quercus virginiana* var. *geminata* (Small) Sarg.), myrtle oak (*Q. myrtifolia* Willd.), Chapman oak (*Q. chapmanii* Sarg.), and palmetto (*Sabal* spp.). The understory of Choctawhatchee stands is primarily deciduous shrubs with some herbaceous ground cover. Turkey oak (*Quercus laevis* Walt.), bluejack oak (*Q. incana* Bartr.), sand post oak (*Q. stellata* var. *margaretta* (Ashe) Sarg.), and pineland threeawn (*Artistida stricta* Michx.), commonly called wiregrass, are the major understory species (6).

Considerable differences exist between Ocala and Choctawhatchee seed production and cone characteristics. Although both commonly produce cones at an early age, about 5 years, Ocala trees have abundant annual cone crops while Choctawhatchee trees produce heavy crops only every 4 to 6 years with smaller crops between (1). Ocala cones are predominately serotinous and persist on the tree for many years. Most of the Choctawhatchee variety cones open in the fall when they reach maturity.

Although rated as moderately intolerant, sand pine is quite tolerant of shade and competition when young. Both varieties will survive underplanting among the scrub oak-wiregrass vegetation found on northwest Florida sandhills. Eventually they will overtop the competition and dominate the site (12). Once established, sand pine can endure considerable drought.

Trees on average sites, site index 60, are 10 to 12 inches (25 to 30 cm) in diameter at breast height (d.b.h.) and average 60 feet (18.3 m) tall at 50 years. Well-stocked natural stands of the Ocala variety will yield 900, 1,350, and

1,800 cubic feet per acre (63.0, 94.5, and 126.0 m³/ha) on poor, average, and good sites, respectively, on a 40- to 45-year rotation (20). On a pulpwood rotation of 25 to 30 years, Choctawhatchee plantations are expected to yield 1,800, 2,700, and 3,600 cubic feet per acre (126.0, 189.0, and 252.0 m³/ha) on poor, average, and good sites, respectively.

Insects, disease, and fire play a significant part in the development and management of sand pine. Bark beetles, primarily *Ips* (*Ips calligraphus* (Germar) and *I. grandicollis* (Eichhoff)), can be a problem after thinnings or partial cuttings. Ocala sand pine, especially in plantations outside its natural range (19) and natural stands over age 40, frequently suffer considerable mortality from mushroom root rot (*Armillariella tabescens* (Scop. ex Fr.) Sing.). Thus, the Ocala variety should not be planted outside its natural range and, within its native range, a maximum rotation age of 40 years is best. The Choctawhatchee variety is quite resistant to the root rot, except when planted offsite on poorly drained soils, and can be managed for sawtimber production with rotations as long as 50 years. On private ownerships, both varieties should probably be managed for pulpwood with rotations of 25 to 35 years (4).

Because of its thin bark, sand pine is relatively susceptible to fire-caused damage and mortality. The Choctawhatchee variety, however, with its typical sparse understory can be prescribed burned under proper conditions (2). The evergreen shrub understory of Ocala stands is usually dense enough to shade out grass and low herbaceous cover. Because of this lack of low base fuels, headfires are necessary to burn the understory, but these are too explosive to use without high risk of losing the entire stand. Thus, prescribed burning is impractical in the Ocala type (7).

Most natural stands of Ocala sand pine have originated from seed released by its serotinous cones following wildfires. Although the effects of fire regenerate the stand, it is undesirable because most of the original timber is lost. Some kind of disturbance is needed, however, to maintain the type; otherwise, these stands would gradually be taken over by the more tolerant scrub oaks.

Sand pine is best suited to even-aged management. Both form and branch pruning are considerably improved when trees are grown in dense, even-aged stands. Under natural conditions, stands are typically dense, pure, and single-storied, although uneven-aged stands do develop during the initial invasion stage of scrub-oak sites (2).

Choctawhatchee sand pine can be successfully regenerated by either seed-tree or shelterwood systems (2). In both methods of regeneration an initial cut is made to stimulate seed production, followed by a final harvest after adequate regeneration is obtained, normally 5 to 10 years. Disadvantages are the possible loss of trees from *Ips* beetle attacks after the initial cutting and damage to regeneration during the final cut. Density control can also be a problem with natural regeneration systems.

Because of its serotinous cones, the seed-tree and shelterwood systems are not suitable for regeneration of

sand pine. Attempts have been made to get natural regeneration by using the heat from the sun to open cones in slash, but stocking has been below acceptable levels. Burning logging slash to release seeds has also been done but it gave poor results because available cones (and slash) were unevenly distributed and fire destroyed seeds (8).

The most successful system for regenerating Ocala sand pine is clearcutting, site preparation, and direct seeding (18). The chopping with a heavy, duplex brush chopper is the preferred method of site preparation because it gives good control of competition and adequate exposure of mineral soil. A prescribed burn may be applied between chops if slash is especially heavy. Broadcast seeding at a rate of 0.5 to 1.0 lb per acre (0.6 to 1.1 kg/ha) should be done from October through November when soil temperatures are the most favorable for seedling establishment. Some method of covering the seed with a layer of soil 0.25 to 0.75 inches (0.6 to 1.9 cm) thick should be used to reduce seed predation and increase germination. Ocala sand pine can also be planted, but due to its lack of dormancy, survival is generally poor (at 60 percent) and variable (6, 12).

Unlike Ocala, the Choctawhatchee variety is easily established with high and consistent survival rates even on sites outside its natural range (3). Growth and survival on sandhill in Georgia and South Carolina indicate that sand pine outperforms other pine species normally planted on these sands (16, 17). Deep planting is recommended, with lings set to a depth that results in the lower branches being covered after the soil settles (4). Recommended thinning densities for 25- to 35-year rotations are 500 to 550 seedlings per acre (1235 to 1360/ha) if no thinning is needed, and 725 to 775 per acre (1790 to 1915/ha) if an immediate thinning at about age 20 is anticipated.

Overstocked stands of sand pine can result from regeneration by seed-tree, shelterwood, or direct seeding. Such stands should receive a precommercial thinning to prevent stagnation and growth loss. Mechanically thinning seedling- or sapling-sized stands in strips using drum choppers or mowers is the most practical method of reducing their density. Trees in older stands and plantations will respond to thinning (5). Thinning in the traditional manner can be used in older stands for regulation of product size. This is more applicable to the Choctawhatchee variety which has better form, smaller branches, and higher wood density, and thus is better suited to sawlog production than is the Ocala variety. Thinning should be done during the dormant season to lessen risk of bark beetle attacks.

Many of the sites where sand pine currently is being established are scrub oak-wiregrass areas with no existing seed source. These sites can be converted by underplanting sand pine among the existing vegetation. Growth of seedlings can be substantially increased by release soon after establishment (3). This is an economically attractive strategy for landowners with small holdings who may not be able or inclined to make a large investment in stand conversion. On larger areas, double chopping followed by direct seeding or thinning is more practical. Because spacing can be controlled, regeneration establishment by planting the Choctawhatchee variety is the preferred procedure.

Site preparation for conversion of scrub oak-wiregrass areas reduces available wildlife foods. Some useful seed-producing species will invade and grow on these sites for a few years after chopping, but they soon give way to grasses (1). Undisturbed strips of scrub vegetation can be left in larger plantations to increase wildlife use (6). In some cases cover can be provided along natural drainages. Even dense stands of Ocala sand pine contain many understory shrubs

that provide mast and forage for wildlife. Production can be increased by clearcutting or thinning (10). Prescribed burning every 3 to 4 years will improve the quantity and quality of forage under Choctawhatchee stands (14).

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